DSAA2043 Project 3 – Efficient Sparse Matrix Addition

Important Notes:

1. The assignment is an individual project, to be finished on one's own effort.
2. **The deadline is tight. No extension is allowed!**
3. Plagiarism is strictly forbidden, regardless of the role in the process. Notably, ten consecutive lines of identical codes are treated as plagiarism.
4. **THERE IS NO LATE SUBMISSION FOR THIS ASSIGNMENT!**

Marking Criterion:

1. The full score of the assignment is 100 marks.
2. There are three tests. Test A is 30 marks; test B is 30 marks; test C is 40 marks. A submission gets the corresponding scores if it passed each test.
3. Test A will use matrices of the size 100 by 50. Test B will use matrices of the size 1000 by 500. Test C will use matrices of the size 10000 by 5000.
4. Zero mark is given if: there is no submission before the deadline; a submission fails all the three tests.

Running Environment:

1. The submissions will be evaluated in Python environment under Linux platform.
2. The submission is only allowed to import the following Python standard libraries: os, sys, and io. No other libraries are allowed.
3. In the test, each program is required to finish within **30 seconds of time**, with no more than **128MB memory. This is a strict requirement measured in the server environment!**

Problem Description:

Write a program that reads two sparse matrices from input files (input1.txt and input2.txt), adds the matrices, and writes the resulting matrix to an output file (output.txt). Below is an illustration of the required format for the input and output files:

```
3, 2
1 1:7 2:9
2 :
3 2:-5
```

- The first line of the file ("3, 2") represents the size of the matrix is 3 rows and 2 columns.
- The second line starts with 1, which means the 1st row of the matrix. "1:7" means the 1st column of the row is 7; "2:9" means the 2nd column of the row is 9.
- The third line starts with "2", which means the 2nd row of the matrix. There are no other elements except a ":", which means all the columns of the row are "0".
- The fourth line starts with "3", which means the 3rd row of the matrix. "2:-5" means the 2nd column of the row is -5.
- All elements that are not listed in the file are treated as 0.
- The example given above represents the following matrix:

$$\begin{bmatrix} 7 & 9 \\ 0 & 0 \\ 0 & -5 \end{bmatrix}$$

Functional Requirement

Write a program called `AddSparseMatrix.py` that reads two matrices from two input files (input1.txt and input2.txt), add the two matrices, and write the result into the output file (output.txt).

Note that in our tests, the input matrices are **sparse**. Most matrix elements (around 95% in tests A and B, around 99% in test C) are zero. All non-zero elements are **integers**.

Note: "input1.txt" and "input2.txt" denotes two files that give the two input matrices. You can assume the two input matrices are always of the same size. "output.txt" denotes the name of the file to write the result matrix.

Appendix

Sample input1.txt, input2.txt, and output.txt are included as examples.